when we consider our whole trade, import and export, with our colonies and with foreign countries." The "analysis of the conditions of our foreign trade," the article states, "leads us back to the ground that the advocates of the change would do well never to have quitted, viz. the comparative merits of the metric and imperial systems. . . . As regards all such important points as logical arrangement and symmetry, ease and swiftness of calculation, simple and direct connection among the fundamental units of length, weight, and volume, there can be no possible room for doubt as to the vast superiority of the metric system." The other article is by Mr. W. C. D. Whetham, and is entitled "Matter and Electricity." It gives a good and complete account of the scientific work of the last seven years, or so far as radiation and radio-activity are concerned. The researches of Becquerel, J. J. Thomson, Rutherford, the Curies, Crookes, Dewar, Ramsay, Soddy, and others are passed in review, and a clear idea is given of what, in the opinion of the best authorities, is the probable physical significance of the results obtained.

THE December number of the *Agricultural Students' Gazette* (Cirencester) contains a lecture given at the college by the new honorary professor of forestry, Dr. W. Schlich, which is of special interest in view of the attention which forestry and education in forestry are receiving at present. By an appeal to figures, the professor showed that the demand for timber in this country increases steadily, and that our foreign supplies rest on an unsafe basis. The British forester has therefore a double incentive to mend his ways, for not only is there the prospect of an advance in prices, but he may, if he will, replace by home-grown timber part of the present imports. In discussing the question, "Will it pay?" Dr. Schlich had to confess that British forests supplied him with no satisfactory data, for none has been sufficiently long under scientific direction, but he was able to show what had been done by Saxony under conditions which are not very different from ours. The forests of that State, which occupy close on half a million acres, have been systematically worked by the Government for more than a century, and since 1817 records have been kept. In 1817 the produce was 61 cubic feet, in 1893 92 cubic feet of timber per acre; while the net return eighty years ago was 4*s*., and in 1900 was 22*s*. 6*d*. per acre. After discussing the cost of production, the lecturer said he estimated that a purchaser who was content to accept 2½ per cent. for his money might pay for land for oak growing 9*l*. 10*s*., for spruce 15*l*., for ash 24*l*., and for larch 34*l*. per acre. As oak requires a much better soil than spruce or larch, it is evident that the profits from growing timber will vary widely with the species grown. The above figures, however, do not take account of diseases, and these sometimes seriously affect profits. Larch, the most valuable of our trees, readily falls a prey to *Peziza Willkommii*, and so destructive has this parasite become of late years that Dr. Schlich fears it may make profitable larch cultivation impossible.

IT appears from the work of the expedition under Colonel Spindler, which has lately explored the Gulf of Kara-bughaz, that this interesting appendix of the Caspian Sea has a great commercial value, its bottom being covered with immense layers of nearly pure Epsom salt (mirabilite). This large gulf, which covers 7080 square miles, and has only a depth of from 34 to 36 feet, is now separated from the Caspian Sea by two narrow sand peninsulas which are nearly joined at their ends, leaving only an 86 fathoms wide channel, through which the water of the Caspian continually rushes into the gulf, to be evaporated there, leaving its salts to be deposited at the bottom. From 18 to 33 cubic kilometres of water enter in this way the gulf every year, and under the rapid evaporation which goes on there (3·2 feet per year) the salinity of the water in the gulf attains as much as 16·3 per cent. Consequently, the bottom of the Kara-bughaz consists now to a great extent of gypsum or of Epsom salt, and it is calculated by the chemist of the expedition, A. Lebedintseff, that the deposits of pure Epsom salt must cover an area of about 1300 square miles, and have a thickness of 7 feet or more. Owing to the small depth of the gulf, this salt can easily be extracted by means of excavating machines.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus*) from India, presented by Mrs. Hughes; a White-backed Piping Crow (*Gymnorhina leuconota*) from Australia, presented by Mr. H. Brack; a Ring-necked Parrakeet (*Palaeornis torquatus*) from India, presented by Mrs. Watts; three Yellow Baboons (*Papio cynocephalus*) from Africa, three Impeyan Pheasants (*Lophophorus impeyanus*) from the Himalayas, two Rufous Tinamous (*Rhynchotus rufescens*) from Brazil, two Tuatera Lizards (*Sphenodon punctatus*) from New Zealand, deposited.

OUR ASTRONOMICAL COLUMN.

INTENSITY OF ATMOSPHERIC LINES IN THE SOLAR SPECTRUM.—The results of an interesting research on the intensities of the atmospheric lines in the solar spectrum are published in No. 8, vol. xlviii., of the Harvard College Observatory *Annals*. The widths of various lines in the D, α and B regions were measured on the solar spectrum charts prepared by Higgs under various recorded atmospheric conditions and solar altitudes. The results thus obtained, after suitable reduction to standard conditions, were analysed, and in cases where a difference exceeding a fixed minimum was found to exist between the width of a line at "high" sun and its width at "low" sun, this line was attributed to absorption in our atmosphere. The lines thus determined as "atmospheric" were compared with those similarly designated by Rowland, and in a few cases in each region the decision of that observer, as to whether a line was truly solar or atmospheric, has been reversed.

Measurements of the widths of six atmospheric lines between λλ 5867·8 and 5905·5 were made on sixteen charts, and the results arranged in a table in which the charts were placed in order of the sun's altitude at the time each chart was drawn. According to the general result the lines should show an increase of width proportionate to the lengths of the paths of the rays through our atmosphere, this increase of width being probably due to the moisture present in the atmosphere. Some abnormal widths were, however, noted, and were found to agree, in effect, with Higgs's remarks as to the state of the atmosphere at the times the respective charts were made. From these results it is concluded that this method is probably the most accurate one known for determining the total amount of moisture, in the line of sight, in the earth's atmosphere.

OBSERVATIONS OF JUPITER.—Some interesting results of observations of Jupiter during 1903 are published by Mr. Denning in No. 340 of the *Observatory*. Between May 26 and November 19 the planet was observed on eighty-four nights, 1200 transits of various markings being observed. It is proposed to continue the observations until the end of the present month, and then to publish the complete results. A few of the more important points in the observed phenomena may, however, be mentioned now.

During the six months completed at the end of November the rotation perod of the Great Red Spot became somewhat lengthened, the mean value being 9h. 55m. 41·7s., as compared with 9h. 55m. 39·0s. in 1902. The large south tropical spot, visible since the spring of 1901, is still easily seen, and has a rotation period of 9h. 55m. 19s. This spot

covers 48° of Jovian longitude, and its centre will be in conjunction with the centre of the Great Red Spot in June, 1904. Differences of period have been exhibited by three of the most conspicuous spots situated on the red, narrow belt north of the N. equatorial belt, their respective periods being (1) 9h. 55m. 35·8s., (2) 9h. 55m. 31·5s., and (3) 9h. 55m. 26·6s. Greater differences of rate have been shown in the N. temperate and N.N. temperate spots, one group of six showing a period of 9h. 55m. 57s., whilst the observed period of another similar group of six was 9h. 55m. 40s.

MERIDIAN CIRCLE OBSERVATIONS OF EROS AND NOVA PERSEI.—The results of the Harvard meridian circle observations of Eros and the comparison stars are published in No. 6, vol. xlviii., of the Harvard College Observatory *Annals*. The comparison stars are those given in *Circulaire* No. 4 of the Conférence Astrophotographique Internationale, and were observed over bright wires in a dark field. Tables showing the elements of the reduction of the observed places are given, and are followed by a table showing the position of Eros on six evenings in November and one in December, 1900.

No. 7 of the same volume of the Harvard College Observatory *Annals* contains the results of the meridian circle observations of Nova Persei and comparison stars. The observations and reductions were similar in character to those made for Eros—except that Nova Persei was observed in a red field over dark wires—and have been made by the same observer, Mr. John A. Dunne. The final table gives the magnitude, the apparent and mean places, and the 1900·0 positions of the Nova, as determined on fourteen dates between February 24, 1901, and January 24, 1902. The observations have all been reduced to Auwers's system of star-places.

PERIODICAL COMETS DUE THIS YEAR.—Mr. W. T. Lynn, in a letter to the *Observatory* (No. 340), gives a short account of the following periodical comets which are due to return to perihelion during this year. Winnecke's comet should become visible in the early part of the year, as it performed its previous perihelion passage on March 20, 1898, and has a period of about 5·8 years. Tempel's comet (1873), having a period of about 5·28 years, was observed on its return in 1894 and again in 1899, and in the latter year it passed through perihelion on July 28. It should therefore return towards the end of the present year.

The now familiar object discovered by Méchain in 1786 and known as Encke's comet has been observed at every return since 1818–19, and should be visible again during the latter end of this year. The period is about 3·3 years, and the last perihelion passage took place on September 15, 1901.

RECENT CONFERENCES OF SCIENCE TEACHERS.

YEAR by year the conferences arranged by the Technical Education Board of the London County Council have increased in importance. This January no less than 850 teachers attended the meetings—which occupied three whole days, January 7, 8 and 9—at the South-western Polytechnic. Moreover, a valuable and suggestive exhibition of matters dealing with its special subject, arranged by the Geographical Association, was opened two days before the conferences began, and the collection remained on view until they ended.

Mr. A. J. Shepheard, chairman of the Technical Education Board of the London County Council, presided over the first meeting on January 7, and gave a very cordial welcome to all present. His opening address dealt with the conclusions which he, as a member of the Mosely Commission, had drawn from his recent visit to the United States of America. By way of introduction Mr. Shepheard very briefly indicated the steps that led up to the inquiries which Mr. Mosely had boldly instituted. The fact that American engineers had succeeded in mining operations when Englishmen had failed raised the question as to whether the success was due to American education. The commission, upon which Mr. Shepheard served, resulted, and it was intended to determine whether there were any points in American education which are superior to our own.

Mr. Shepheard found that in America there was a more largely diffused spirit of education and a greater belief in its necessity and value than here in England. The American people were taught to cherish the idea that they had a right to the best education possible, and at the expense of the State; while the State recognised clearly its duty in this respect, and regarded such work as the best investment that it could make.

Here there is an undoubted lesson to England, and Mr. Shepheard strongly urged all who believe in education, not to let the matter rest until every citizen feels that this nation will never be what it ought, until everyone is educated to the fullest extent to which he or she is capable. America, Mr. Shepheard went on to say, was fortunately free from "the religious difficulty," and in this country in future, sectarian questions must be strictly kept in the background. Education in America is free up to the age of eighteen years, and the universities are more open than here. The manner of teaching is more practical, and without losing our reputation for culture we might consider this point more. The value placed upon nature-study in the United States was considered by Mr. Shepheard, who dwelt upon observational work, painting from nature, weather notes, and the consideration of all natural objects of interest. Finally, Mr. Shepheard discussed manual training, the trade high schools, and the career of a student in such institutions as the Boston Technical School and the universities.

Mr. H. J. Mackinder, reader in geography to the University of Oxford, contributed the first paper, entitled "The Development of Geographical Teaching out of Nature-Study." He digressed for a moment to point out that there was no great antithesis between culture and practical education. We are creatures of history, and we have chosen different methods of cultivating imagination from those adopted by the Americans. Geography, he said, was calculated to expand the imagination, and should start with the home. He quoted the paragraph on the scope of nature-study from the judges' report of the exhibition held in 1902, and proceeded to show that geography, as now understood, followed many of the same paths. Mr. Mackinder sketched out some excellent methods of teaching geography, beginning with the construction of a rough plan, and discussed the use of globes and maps without lettering before dealing with such as are commonly used, and which, as he says, tend to dwarf the imagination. He had something also to say about the far-reaching commercial importance of geography, and all right thinking people will support his plea that the idea be at once stamped out which implies that the British possessions can be studied apart from the world as a whole.

At the afternoon meeting Sir John Cockburn in a telling manner summarised from the chair the various matters at issue. Mr. Kendall, of the Yorkshire College, Leeds, described some ingenious methods of filling in the steps of models (made up of thicknesses of cardboard cut according to contour lines) with dry material, which is set by having water sprayed upon it.

Mr. J. Lomas, when treating of excursions, gave a description of a ramble along the banks of a tiny stream in Cheshire. He showed with the help of some specially prepared lantern slides, the questions which it, in common with larger rivers, asks and—yielding to the careful observations of the nature student—likewise answers. Why is here a waterfall? Why is there a patch of sand? The fact that the stream is small is a great help in determining what has altered and is altering its course, and in making experiments to determine the direction of various currents. Mr. Lomas concludes that the object of teaching should be to see that the pupil receives correct impressions, and the only way, he says, to secure this is by observation.

Dr. A. J. Herbertson showed by means of a lantern a number of Ordnance maps illustrating typical regions, and considered the points that go to make a good map. He alluded also to the issue of Ordnance Survey maps to schools for teaching purposes (owing to recommendations of the Geographical Association) at a cost of 25*s*. per hundred for outlines and 35*s*. for the same number when hill-shading is added.

Mr. T. Alford Smith gave an account of the use of simple